

## Session 5B: Ecological Modeling and Assessment

### Questions & Answers

**Stephen Romaine**

**Q: What is the pattern of euphausiids outside the study area?**

**A:** We've gone into a lot of the inlets and we have found the inlets are just teeming with euphausiids. Part of the reason is we think is that the winter conditions tend to delay longer in the inlets, and we find that euphausiids tend to be larger but they tend to almost have a two-year life cycle because the colder water. We've also run some surveys off the west coast up to the Queen Charlotte and other places, but these are sort of hit-and-miss surveys, just sort of seeing what's out there. We were out there in August and we found there's very little in the way of euphausiids off Vancouver Island, which kind of surprised us...ran up to the Queen Charlotte we found lots of euphausiids and we also found a lot of hake so they tend to be, I believe...one of the authors that's working on hake tends to say, "hake tend to be planktonic,"... they tend to follow the plankton, they don't really decide where they go off the west coast and in the Strait of Georgia they seem to more limited to the basins.

**Q: What else can feed off the euphausiids?**

**A:** All the fish do. A major food source for the salmon is the euphausiids when they are not feeding off copepods, a lot of the other fish do as well. We once did a bunch of herring studies as well, we found a lot of the herring were eating 100 percent euphausiids as well. I'm not too sure about the dogfish. We haven't gone to analyze the dogfish yet to see what they are eating.

**Carol Piening**

**Q: It looked like it was in the middle of herring and surf smelt spawning grounds and kelp beds, how did they justify?**

**A:** That's a really good question, there was an extensive, but site-specific, assessment done to try to figure out what are the potential impacts that this wing on the pier could have and how can we mitigate for those. As far as docks go, it's state-of-art and has been well considered and it has as few impacts as can be, but the decision to let them go ahead and build...I think it was made before I really began working for DNR...but I believe it was made on a this particular instance will not do enough further harm to be significant so we believe the economic benefits outweigh the environment deficits. Let's go ahead and build it. It's coming up with decisions like that that make us realize we do need a tool to be able to look at the whole elephant and not just at the one instance that's before us.

**Q: Because it seems they are whittling away at something that's in decline anyway.**

**A:** There's indications that that's what's going on.

**Q: Is there any data about herring spawning the last time that the Pacific Decadal oscillation was in a warm, dry phase?**

**A:** No, because I think that was in about 1940 and we were not paying much attention then.

**Q: If the habitat use is shrinking to one particular area, that's evidence that something is happening to the herring that is outside of what's going on at Cherry Point. The activities at Cherry Point could have an impact, but that one also needs to understand what else is happening to the herring when they are not in the spawning grounds?**

**A:** That's another thing that I hope that using risk assessment will help us to come to understand.

Wayne Landis

**Q: I didn't hear anything about burden of proof or principle of precaution in your risk assessment, particularly with the preceding talk. It seems like DNR has the complete burden of proof here. I'd like to know how that figures in your compilation?**

**A:** We don't [have] burden of proof. What we do is as a precautionary principle [is] we'll actually go through and tell you what the relative risks as in probability is of each of these events being due to this stress or that stress or in this other kind of thing. It's not exactly human health assessment. Also, we go through and say and we can do the uncertainty analysis and sensitivity analysis. The uncertainty here as I mentioned is in the contaminant loading because we don't have very good data for that. We do know there's exposure to the effects of the PDO; we do know that these populations have exploited and herring are still exploited in the Canadian waters. So we do know that those things certainly do exist. The uncertainty there comes in the impact of the herring. The greatest sensitivity of these models is the exposure, and with all the work that has been done in this region it is so hard to completely understand what the exposure and that's where most of the uncertainty is. Once you have exposure, you can go and look and see if the organism lives there and be able to rank that. That's essentially how you go through and rank it, and it's very typical of what's done in any kind of ecological risk assessment, whether it be EPA method, OACD, Australia and New Zealand have a combined methodology and so what we do fits very well into the rest of that.

**Q: My question is with these models, they do have applications for decision-makers and you have indicated that exploitation, climate, and cost of nearshore issues maybe a contributing factor for the herring. So what then can we do with this population that is now has decreased in range? What do decision-makers do about that chain of events?**

**A:** That's in the end of the report we wrote for Carol. Without habitat there is no risk because they are not going to be there. If you look into the future as to what the critical risk factors are, it's going to be climate change. But even if the 20-30-year cycle turns around and there is no habitat you will have no herring. The habitat becomes very critical, and it's not just the spawning habitat, of course, but all the other habitats that the organisms utilize before they come on shore at Cherry Point—it looks like there are some habitat issues there as well if you turn 3 and die. So it's not just a nearshore/onshore environment but also something else happening within the Straits or upper Puget Sound that needs to be protected. The difficulty is that we are not clear what the Cherry Point herring are: if they are part of the Straits of Georgia herring population, if they are part of a unique population, if they are part of the lower Puget Sound herring. We don't have the information on that. However, the BC herring do apparently belong to a meta population and it's not the only forage fish. Weak fish on the east coast, they are found all throughout the east coast, people for along time assumed that they are one population. Apparently they are a patchy population or in fact a classic meta population, and how you would manage those populations really depends upon what their true structure is.

**Q: How would you use your alternative indicators in order to help Carol make decisions about the dock?**

**A:** Let's see here, what lives where the dock is going to live? Dungeness crab, potential impact; the seagrass or kelp beds, potential impact. Do they use that habitat at low tide, yes or no? And we can actually go through and say, "OK here's the tradeoffs, you get a dock in, but here are the alternate kinds of organisms that you could have an impact on." Plus once you put in a dock or sometimes the construction for that or let's say you were going to add a town to that area, well, that's going to be a very permanent long-term...exposure. What are going to be the long-term deals that come on those endpoints, which are not herring on those particular resources? And that's the key here, is that they are all resources, and I think it's called a permanent natural resources. All these kinds of things can certainly help Carol make that decision where the extraction of resources, utilization of that area outweighs those other kinds of resources that you can put a monetary value to if you wanted to and start making those kind of tradeoffs.

**[Question not recorded.]**

**A:** Environmental Impact Statements are not probabilistic. This is. We can actually say you have a greater chance of impacting this, this and this. Actually, Environmental Impact Statements, since they are not probabilistic and they tend to be not as quantitative as I would like, I don't see them as very good decision-making tools.

**Q: Where do they congregate and then do they come on shore to spawn on their natal beach?**

**A:** It's clear if they use their natal beach, herring do spawn offshore and on Alden bank, and that area is actually not just a congregation for the fish that spawn at Cherry Point. But if you do a trawl there you'll find fish in all different stages of reproductive state. Some of them apparently are ones that would spawn in other areas, but all herring seem to like Alden Bank, and that a certain number come on shore. In the past, it was the older fishes, age classes 4 or older that would actually come on shore first, then followed by the age class 2 and 3, and of course, not that's not possible.

**Stephanie Sylvestre**

**Q: Did you look at the mean annual maximum temperature or annual flows over the course of the year?**

**A:** The original approach was that we wanted to, first of all, have consistent sampling so that we decided that fall during low flow was going to be the period of which we would do this. For a couple of reasons. Invertebrate biology, for one, needed to be consistent. We needed to be able to access the streams. We also wanted to be certain that the streams we were sampling were wet throughout the entire year; we didn't want to be sampling in an area that was maybe two weeks ago. It's been correlated that it is the habitat variables. They are sort of more important at that particular time, like some of the streams which fluctuate in flow dramatically. The invertebrate communities can be so patchy that I think if we took annual velocities we might lose the detail. At any rate, no, we didn't use it and that has been the protocol both here as well as in Britain, which is where this approach was originally designed as well as in Australia, so it's sort of instantaneous habitat variables rather than annual.

### **General Questions**

**Stephanie**

**Q: Do you ever go back to your site that you say is one of your reference sites and see if it still fits into your reference space?**

**A:** Actually, in the initial FRAP program, that's what they did. They looked at over 3 years' time, they went back to some of the original reference sites to determine if they were consistent from year to year, so yes we have done that.

**Q: And what was the result?**

**A:** They were consistently referenced.

**[Question not recorded.]**

**A:** DNR declared a reserve for Cherry Point in May of 2000 and the stated purposes of that reserve is to give emphasis to the environment as opposed to the economic uses of the area. We need to take that into consideration.